


North Coast Watershed Assessment Program

DRAFT

# Mattole Watershed Synthesis Report



*The mission of the North Coast Watershed Assessment Program is to conserve and improve California's north coast anadromous salmonid populations by conducting, in cooperation with public and private landowners, systematic multi-scale assessments of watershed conditions to determine factors affecting salmonid production and recommend measures for watershed improvements.*

Public Review Draft - March 22, 2002

# Executive Summary

## Introduction

This report constitutes a second public review draft of the North Coast Watershed Assessment Program's (NCWAP) watershed assessment work on the Mattole River basin. The NCWAP was established in 2000 to provide a consistent scientific foundation for collaborative watershed restoration efforts and to better meet the State needs for protecting and restoring salmon species and their habitats under state and federal laws. The program includes the California Resources Agency, Department of Fish and Game (DFG), Department of Forestry and Fire Protection (CDF), Department of Conservation / Division of Mines and Geology (DMG), Department of Water Resources (DWR), the North Coast Regional Water Quality Control Board (NCRWQCB), and the Institute for Fisheries Resources (IFR).

This content of this report should be considered preliminary and subject to review and revision. This assessment was limited in scope (e.g., marine habitat and fishing effects on salmon were not considered), detail, and analysis in accordance with program goals, timeframes, and budget and schedules. There will be additional public and scientific review of this draft in order to refine analyses and revise recommendations as needed. A final watershed assessment report is to be completed in May 2002.

The Mattole River basin encompasses approximately 296 square mile of the Northern California Coast Range. A small portion of the Mattole's southern most headwaters originate in Mendocino County, but the vast majority of the basin is within Humboldt County. The Mattole has a Mediterranean climate characterized by cool wet winters with high runoff, and dry warm summers with greatly reduced flows. The Mattole basin receives one of the highest annual amounts of rainfall in California averaging 81 inches. The Mattole basin is mostly steep mountainous topography. Broad, alluvial streamside flats are present in the lower valleys. The total Mattole basin resident population in the year 2000 census was estimated at about 1,200 people. Eighty-four percent of the watershed is held and managed as private property. In the 1941 air photos, the most widespread land use of the watershed appears to have been grazing. Timber harvest operations began in earnest during the post World War II boom.

By the late 1980s, timber harvesting decreased while environmental awareness increased. Changes in policy concerning management of Federal lands and the designation of the Northern Spotted Owl as federally threatened led to the designation of BLM lands, a large proportion of the Western and a smaller percentage of the Eastern subbasins, as Late Succession Reserve lands that are not subject to harvest (BLM, Bear Creek 1995).

## Salmon, Stream, Watershed, Land-use Context

Chinook salmon, coho salmon, steelhead trout, and cutthroat trout populations have experienced severe declines on the West Coast, including North Coast California, during the past century. Fish ladder counts at two sites on the Eel River, the Mattole's nearest neighbor, reflect the approximately eighty percent reductions in coast wide anadromous salmonid stocks. Concerns over the status of coastal salmonids have led to many of them being listed under the authority of the Federal Endangered Species Act, which has brought about ensuing regulation from the National Marine Fisheries Service.

Anadromous Pacific salmonids spend over half their life history in the marine environment, which is generally beyond man's control other than to regulate harvest. However, they are also dependent upon a high quality freshwater environment at the beginning and end of their life cycles. As such, they thrive or perish depending upon the availability of cool, clean water, free access to migrate up and down their natal streams, clean gravel for successful spawning, adequate food supply, and protective cover to escape predators and ambush prey.

These life requirement conditions can be identified and evaluated on a spatial and temporal basis at the stream reach and watershed levels. They comprise the factors that support or limit salmonid stock production.

The results of a major watershed disruption, which can be created over time by many smaller disruptions, can drastically alter instream habitat conditions and the aquatic communities that depend upon them. In general, natural disruption regimes do not impact larger watersheds, like the 300 square mile Mattole, in their entirety at any given time. Rather, they rotate episodically across the watershed creating a shifting mosaic of habitat conditions. Human disturbances, although individually small in comparison to natural events, are often concentrated in time and space across basin level watersheds because market driven land uses tend to function in temporal waves, like the California Gold Rush or the post-WWII logging boom in Northern California. The intense human land use of the last century, combined with the energy of two mid-century, record floods on the North Coast, created stream habitat impacts at the basin and regional scales across most of the North Coast region, including the Mattole River.

## **Subbasin Scale**

In order to be more specific and useful to planners, managers, and landowners, it is often useful to subdivide the larger basin units into smaller subbasin units whose size is determined by the commonality of many of the distinguishing traits. Natural variation among subbasins is at least partially a product of natural and human disturbances. Other variables that can distinguish areas, or subbasins, in larger basins include differences in elevation, geology, soil types, aspect orientation, climate, vegetation, fauna, human population, land use and other social-economic considerations. The combined complexity of large basins makes it difficult to speak about them concerning watershed assessment and recommendation issues in other than very general terms. For the purpose of this assessment, the Mattole Basin has been subdivided into five parts: the estuary and four subbasins (Northern, Eastern, Southern, and Western).

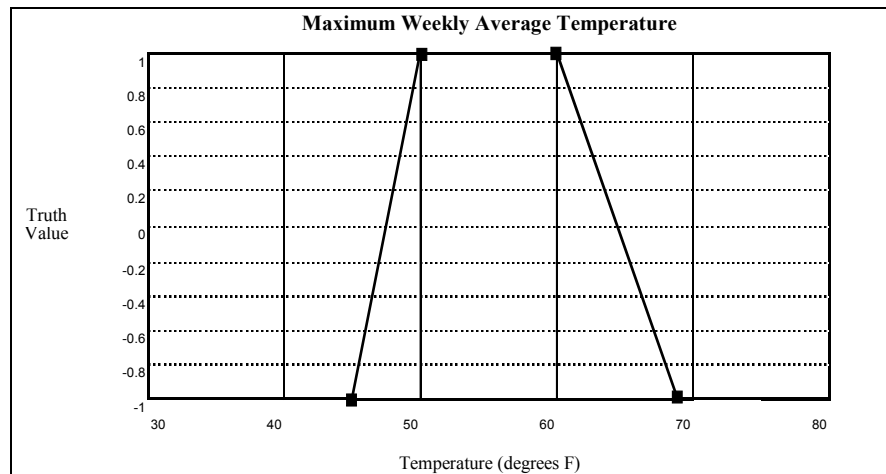
## **Assessment Components**

A main component of the NCWAP is an analysis of stream habitat conditions to identify factors that limit production of anadromous salmonids in North Coast watersheds. The "limiting factors analysis" (LFA) provides a means to evaluate the status of a suite of key environmental factors that affect anadromous salmonid migration, spawning, and juvenile rearing.

As part of the watershed assessment, the NCWAP team is using computer models called knowledge base or expert systems. The software allows scientists to combine data of different environmental factors, such as stream temperature and substrate composition, to produce a synthesis of watershed conditions for native salmonids. For this purpose, the NCWAP will employ a linked set of software: NetWeaver, Ecological Management Decision Support System (EMDS) and ArcView™. NetWeaver. These networks resemble branching tree-like flow charts, and graphically show the logic and assumptions used in the synthesis.

The NCWAP scientists start from the proposition that the overall condition of a given watershed is suitable for maintaining healthy populations of native salmon and trout, and through the design of the knowledge base (the network) seek to evaluate the 'truth' of that assertion. To evaluate watershed

conditions for salmonids, the scientists specified that data are required on upland condition, roads, passage barriers, and stream condition factors. In a similar manner, each of the four main environmental factors is actually made up of smaller constituent components. For example, 'upland condition' is determined by detailed data on land use, land cover (vegetation), and slope stability. Scientists use simple graphs that show what are completely unsuitable temperatures (-1), completely suitable temperatures (+1) and those that are in-between ( $> -1$  and  $< +1$ ).



**Figure 1: EMDS Response Curve**

The software offers a number of advantages. The graphs and flow diagrams required that the NCWAP scientists be forthright and explicit in how they have defined suitable conditions for salmonids needed for the completion of their lifecycle. The nature of the networks assists open communication to the general public through simple graphics and easily understood flow diagrams. Another feature of the system is the ease of running alternative scenarios. Scientists and others can test the sensitivity of the assessments (i.e. perform 'sensitivity analyses') to different assumptions about the environmental factors and how they interact, through changing the knowledge-based network and breakpoints. NetWeaver ranks the environmental factors by their influence on the overall habitat indicator values derived. They also show which factors, with more complete and comprehensive data, would improve the quality of the analysis in the most cost-effective manner. Maps depicting those factors that may be the largest impediments, as well as those areas where conditions are very good, can help guide protection and restoration strategies. The EMDS model can also help to assess the cost-effectiveness of different restoration strategies.

## Conclusions and Recommendations

Although the watershed has a history of producing significant quantities of chinook and coho salmon and steelhead trout, currently there are a number of impairments to salmonid habitat identified in the Mattole River watershed:

- Insufficient surface stream flow depth and volume;
- Lack of stream habitat structure such as deep pools;
- Increased predation of juvenile salmonids;
- Lack of large woody debris and streamside vegetation;

- Unsuitably high summer stream and estuary water temperatures;
- Loss of functioning estuary habitat;
- Loss of estuarine connectivity with the sea.

These impairments result from a variety of processes. Episodic pulses of sediment moving through the system during high water flows have resulted in excessive fine sediment deposition, stream channel shallowing and widening in low to moderate gradient reaches, and estuarine impacts. Increased juvenile salmonid predation occurs from loss of protective cover provided by large woody debris and streamside vegetation. Land management activities—such as road construction, timber management, and land development—have interacted with areas of natural geologic instability and sediment production, and major rainstorm events (e.g., the 1955 and 1964 floods) to contribute to salmonid habitat impacts.

One particularly complex salmonid habitat suitability issue—stream water temperature—needs additional analysis in light of the multifaceted interrelationships between stream water temperature and factors such as air temperature, streamside vegetation, channel width and depth, ground water influences, and basin size. Current water column chemistry information in the Mattole River is deemed insufficient to evaluate the suitability of nutrients, dissolved oxygen, phosphorous, and nitrogen levels for salmonids.

EMDS model runs conducted on the Mattole indicate that the headwaters (Southern, Eastern, and Western subbasins) area of the system is in relatively good condition. The Northern and Estuarine subbasins are in relatively poor condition for supporting salmonid populations.

The sections below provide specific conclusions and recommendations for each of the five Mattole subbasins.

## ***Estuary***

Estuaries are critical habitats for all anadromous salmonids. Estuaries are the connection between freshwater and marine environments through which salmonids pass as juveniles during seaward migrations and as adults to gain access to their native rivers during spawning migrations. Estuaries are also recognized as valuable salmonid nursery areas because they provide abundant food supplies, diverse habitat and offer protection from predators. Fish that utilize estuaries for an important part of their life cycle, such as salmonids, are referred to as estuarine-dependent.

The Mattole estuary provides an important transition between marine and freshwater environments. Sediment supply to the estuary is naturally high due to its downstream position at the mouth of the Mattole River. Naturally high erosion rates, major storms, and upstream human-caused disturbances in the estuary have exacerbated sediment accumulation in the estuary and reduced the quantity and quality of habitat for salmon. Water temperatures in the estuary have exceeded the “fully” suitable range for salmonids since at least 1987 when monitoring began.

Improvements to estuary conditions for salmon must be initiated through sediment yield reduction efforts throughout the upstream areas of the system. Sediment input reduction is key to improvement in estuary conditions. The actions that could benefit the estuary are discussed in more detail in the sections for those upstream subbasins. In general, activities that reduce sediment generation and transport, and that help to lower water temperatures will benefit salmon habitat conditions in the estuary.

## ***Estuary Subbasin Issues***

- Sediment and temperature impacts are currently deleterious to summer rearing salmonid

populations. Present conditions are a product of upstream natural processes and human land uses. Although summer water temperatures are currently documented to be higher than fully suitable EMDS values, there is not enough information over time to understand temperature trends. Because juvenile chinook over-summer in the estuary, they are affected by temperature to a greater degree than steelhead or coho.

- Field observations during extensive academic studies and ongoing field observations by the DFG and the Mattole Salmon Group indicate that pool habitat, escape and ambush cover, water depth, substrate embeddedness, and water temperature are likely unsuitable for salmonids.
- The life cycle of young chinook historically included a summer rearing phase in lagoon or estuarine habitats. Juveniles typically entered the estuary in spring and left for the sea in autumn. In response to the unsuitable estuarine conditions for rearing chinook juveniles, the Mattole Salmon Group has conducted rescue rearing operations since 1994. The project traps down migrating chinook juveniles at river mile 3.0 adjacent to summer rearing tanks at Mill Creek, and releases them in the fall for out-migration. This project needs to continue as an assessment program to evaluate its efficacy by marking all released fish.
- The bedrock underlying the uplands above the Estuary is dominated by *mélange* and much of the uplands above the Estuary are underlain by large dormant landslides. No active landslides were mapped in this subbasin. The Estuary uplands generally have a moderate to very high landslide potential (CGS, 2002).
- Between 1942 and 1965 the Mattole Estuary widened, and areas of vegetation were lost, however, trends from 1984 to 2000 show: a progressive increase in vegetation along the south bank; a decrease in the width of the active channel; and smaller areas of braided stream channel. The system of gravel bars along the Lower Mattole has remained relatively constant over the last 15 years, with minor changes observed chiefly with respect to the location and development of vegetated bars (CGS, 2002).

## ***Estuary Subbasin Issue Synthesis***

### **Working Hypothesis 1:**

**THE PRESENT STATE OF ESTUARINE HABITAT IS LIMITING THE PRODUCTION OF SALMONIDS, ESPECIALLY CHINOOK, IN THE MATTOLE RIVER.**

### **Supportive Findings:**

- Estuaries provide critical habitat for all anadromous salmonid species.
- Sediment from upstream has been delivered by storm events and has accumulated in the low gradient estuarine channel.
- Sources of upstream sediment include natural background erosion and additional erosion from land use.
- Water temperatures in the estuary, as a result of warming effects upstream, periodically exceed a level that is fully supportive of salmonids (Dynamics of Recovery 1995).

### **Recommendations:**

1. Continue the chinook juvenile rescue rearing and fish tagging program and incorporate an effectiveness monitoring program.

2. Institute a basin-wide road/erosion assessment, treatment and erosion control program to reduce sediment yield where possible. Follow land use guidelines such as Department of Mines and Geology Note 50 (Department of Conservation, 1997; see Appendix X).
3. Maintain and enhance existing riparian cover. Use cost share programs and conservation easements as appropriate.
4. Monitor summer water and air temperatures on a continuous 24-hour basis to detect long-range trends and short-term affects on the aquatic / riparian community.
5. Examine the role of the mainstem Mattole River in elevated estuarine water temperatures.

### ***Northern Subbasin***

The Northern subbasin is located between the estuary and Honeydew Creek (River Mile 26.5) along the northeastern side of the Mattole mainstem. There are eighteen perennial streams that drain a watershed area of 98 square miles. The DFG has recently surveyed 10.6 miles of the subbasin's anadromous reaches. Elevations range from 5 feet near the estuary to approximately 2,500 feet in the headwaters of the tributaries. The watershed is largely managed for timber production and cattle ranching. The town of Petrolia is located in this subbasin at the confluence of the Lower North Fork and the Mattole River. Some back-to-land homesteads are near Petrolia.

### ***Northern Subbasin Issues***

- There is concern over abandoned roads, new road construction, and road maintenance issues related to land-sliding and sediment input. Without appropriate maintenance or storm proofing, existing roads, both active and abandoned, may continue to contribute high rates of sediment.
- Currently, there is no road assessment program in this planning basin.
- If future sub-division development is proposed, the county-imposed 40-acre minimum parcel sub-division ordinance with the preponderance of unstable slopes and sediment issues will need to be addressed.
- The bedrock underlying the northern subbasin is dominated by mélangé which is highly susceptible to landslides and erosion. The subbasin contains some of the largest continuous areas of large landslides, historically active earthflows, and high to very high landslide potential; of the all the subbasins (CGS, 2002).
- The delivery of sediment to streams is prevalent through gully erosion and debris slides associated with large active and dormant landslides as well as from debris flows and debris slides which form on the harder terrain at higher elevations (CGS, 2002).
- In the Lower North Fork, the high rate of sediment input from erosion and mass wasting is reflected in the accumulation of debris and alluvial fans at the mouths of many tributary drainages (CGS, 2002).
- Eroding banks are found in localized areas throughout the Northern subbasin and are commonly associated with areas of inner gorges and active landslides. The Rattlesnake Creek, Long Ridge, McvGinnis Creek and Oil Creek PWs have some of the longest total lengths of eroding bank within the subbasin. (CGS, 2002)

- The Northern subbasin is the only subbasin within the Mattole Watershed that shows a significant increase in the number of gullies from 1984 to 2000. (CGS, 2002)
- The Cow Pasture Opening Planning Watershed (PW) is the only PW in the Northern subbasin that has demonstrated an increase in both the number of gullies and negative channel characteristics from 1984 to 2000. (CGS, 2002)
- Water temperature data suggests that summer high temperatures exceed fully suitable conditions for salmonids throughout much of this planning basin.
- Based upon limited samples from Oil and Rattlesnake creeks there is an indication that fine sediments may be approaching or exceeding levels that are considered suitable for diverse and complex salmonid habitat.
- Canopy density (cover) is below EMDS target values. Excess instream sediment appears to be causing channel widening, leading to less stream canopy density.
- Based on limited sampling taken from 1991 to 1999, mainly in the Upper North Fork drainage, coho have not been found. Four years of electrofishing in three streams (Oil, Green Ridge, and Rattlesnake creeks) show stable multi-year class populations of juvenile steelhead.
- Large woody debris recruitment potential is very poor overall due to prevalence of grasslands and lack of streamside vegetation. Land use practices may be exacerbating the naturally occurring adverse conditions.
- Fish population information is poor due to access issues for surveys. In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this planning basin.

### ***Northern Subbasin Issue Synthesis***

#### **Working Hypothesis 1:**

**SUMMER STREAM TEMPERATURES IN MANY SUBBASIN TRIBUTARIES ARE NOT WITHIN THE RANGE OF TEMPERATURES THAT ARE FULLY SUITABLE FOR HEALTHY ANADROMOUS SALMONID POPULATIONS.**

#### **Supportive Findings:**

- Summer stream temperatures were measured to exceed levels fully suitable for salmonids at most locations sampled.
- Shade canopy levels appear to be low as a function of both riparian cover depletion from land use and stream widening due to high sediment inputs resulting from floods in 1955 and 1964.
- Air photo analysis indicates that in timberland areas, timber harvest activities prior to 1973 also reduced canopy closure near streams.
- Air and historic photo documentation, after the 1955 and 1964 floods, indicate significant changes in many channels in the Northern subbasin.

### **Working Hypothesis 2:**

**AGGRADATION FROM FINE SEDIMENT IN SOME STREAM CHANNELS OF THIS SUBBASIN HAS REDUCED CHANNEL DIVERSITY NEEDED TO PROVIDE SUITABLE CONDITIONS FOR ANADROMOUS SALMONID POPULATIONS AND HAS COMPROMISED SALMONID HEALTH.**

### **Supportive Findings:**

- Field surveys indicate that sediment delivery has had an adverse and long lasting impact to salmonid habitat in the Northern subbasin.
- Air [DFG3]photo analysis and field observation indicate that the lower reaches of the large tributaries to the Mattole River are highly aggraded with fine sediment.
- Late [DFG4]summer field observations indicate that aggradation and channel widening have likely contributed to a loss of surface stream flow.
- Several areas of on-going high sediment deposition were observed along the Lower North Fork near Petrolia and Upper North Fork near Honeydew. These areas of deposition have been attributed to backwater effects with the mainstem Mattole River. Backwater effects occur where the stage versus discharge relationship is controlled by the geometry downstream of the area of interest (e.g., a high riffle controls conditions in the upstream pool at low flow). However, in the case of the Lower North Fork at Petrolia and the Upper North Fork at Honeydew, we conclude from our observations that the backwater effects mapped at these locations are controlled by a hydrologic point of constraint caused by the mainstem Mattole at high flows (CGS, 2002).

### **Contrary Finding:**

- Review of photographs from the early 1900s combined with anecdotal statements indicate that the Lower North Fork of the Mattole River near Petrolia has been an area of episodic sediment accumulation since the early 1900's. (CGS, 2002).

### **Working Hypothesis 3:**

**A LACK OF LARGE WOODY DEBRIS IN SOME STREAM REACHES OF THIS SUBBASIN HAS REDUCED CHANNEL DIVERSITY NEEDED TO PROVIDE SUITABLE CONDITIONS FOR ANADROMOUS SALMONID POPULATIONS AND HAS COMPROMISED SALMONID HEALTH.**

### **Supportive Findings:**

- Field observations indicate that the amount of instream large woody debris in the mainstem Mattole River and its tributaries in the Northern subbasin is inadequate.
- Riparian vegetation is in small diameter size classes that are not expected to contribute large woody debris in significant quantities in the near future.

### **Recommendations:**

1. Monitor summer water and air temperatures to detect trends using continuous, 24 hour monitoring thermographs.
2. Where current canopy is inadequate and site conditions are appropriate, initiate tree planting and other vegetation management to hasten the development of denser and more extensive riparian canopy.

3. Encourage the use of cable or helicopter yarding on steep and unstable slopes to reduce soil compaction, surface disturbance, and resultant sediment yield.
4. Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.
5. Maintain and enhance existing riparian cover. Use cost share programs and conservation easements as appropriate.
6. Based upon the latest science on placement of large woody debris instream channels, managers in the Northern subbasin should work to improve channel structure and function, and habitat complexity and diversity for salmonids.
7. Continue efforts such as road erosion proofing, improvements, and decommissioning throughout the basin to reduce sediment delivery to the Mattole River and its tributaries.
8. At stream bank erosion sites, encourage cooperative efforts to reduce sediment yield to streams.

### ***Eastern Subbasin***

The Eastern subbasin is located between Honeydew Creek (River Mile 26.5) and Bridge Creek (River Mile 52.1) along the eastern side of Wilder Ridge, and the Mattole mainstem above Bear Creek, for a distance of about 25.6 river miles. There are fifteen perennial streams that drain a watershed area of 79 square miles. The DFG has recently surveyed 22.2 miles of the subbasin's anadromous reaches. Elevations range from 344 feet at Honeydew Creek to approximately 2,300 feet in the headwaters of the tributaries. The Eastern subbasin has the highest rainfall averages in the Mattole, ranging from 85 inches near Thorn Junction to 115 inches in the hills east of Honeydew. Temperatures are typical of other inland areas of California with sub-freezing winter temperatures and above 100° F summer temperatures.

### ***Eastern Subbasin Issues***

- Roads – There is concern over abandoned roads and new road construction, and road maintenance issues related to landsliding and sediment input. Without appropriate maintenance or storm proofing, existing roads, both active and abandoned, may continue to supply sediment. Road inventories have been completed for a small portion of this subbasin, and it is recommended that this effort be continued until a complete inventory is compiled.
- This subbasin is heavily sub-divided so that there is high impact on the land from road density, human habitation, land disturbance from building of structures, and land modification, including diversion of surface waters.
- Moderate to large dormant landslides, landslide complexes, and large active landslides were mapped in the soft and to a lesser degree moderate terrains, whereas moderate and occasionally large dormant and small active landslides are scattered throughout the hard terrain (CGS, 2002).
- Debris slide slopes are mapped extensively throughout much of the hard terrain and locally with a lower density and concentration in the moderate terrain. Debris slide slopes are rare in the soft terrain.
- The soft terrain of the mélange matrix and fault/shear zones has been interpreted as having very high landslide potential. The moderate terrain has been assessed as mostly having a moderate landslide potential with some areas of high to very high potential. The hard terrain has been

interpreted as mostly in the moderate landslide potential with localized areas of very high potential (CGS, 2002).

- The 2000 air photos show that every planning watershed within the Eastern subbasin has shown a significant decrease in negative channel characteristics, with no significant change in the number of gullies. Blue Slide and Westlund Creeks have demonstrated a dramatic reduction in lateral bar development, which suggests a decrease in excess sediment (CGS, 2002).
- A sizeable area of sediment deposition was observed along Dry Creek immediately up stream from a large slide. This area of deposition has been attributed to backwater effects along Dry Creek which are related to this large persistent slide acting as a hydrologic point of constraint. Backwater effects occur where the stage versus discharge relationship is controlled by the geometry downstream of the area of interest (e.g., a high riffle controls conditions in the upstream pool at low flow (CGS, 2002).
- The mouth of Mattole Canyon is another area that which has been a long-term area of sediment accumulation. This can be attributed to weak rocks and numerous slides up canyon and a reduction of gradient near the area of deposition (CGS, 2002).
- The majority of eroding banks within the Eastern subbasin appear to be located within the Sholes Creek and Dry Creek PWs and along the Mainstem of the Mattole River. The Sholes Creek PW has the longest total length of eroding bank in the Mattole watershed (as mapped from the 2000 air photos) (CGS, 2002).
- Air photos and field observations show that the Mattole River bordering the Eastern subbasin downstream of the Honeydew landslide is highly aggraded with sediment (CGS, 2002).
- A diesel [DFG5]spill in Blue Slide Creek, reported in April 2000 to the North Coast Regional Water Quality Control Board, is currently undergoing remediation and monitoring by the Board.
- Water temperatures – Available data suggests that summer high temperatures exceed fully suitable conditions throughout much of this subbasin in the lower depositional reaches of most tributaries. Mattole Canyon Creek has elevated temperatures in most of its reaches.
- Large woody debris recruitment potential is generally adequate for the majority of this subbasin with the exception of the grassland areas high along the eastern margins.
- Based on limited summertime fish samples, few coho have been found in tributary surveys. In 2001, the DFG Coho Assessment Project staff found coho in two streams in the subbasin. Steelhead populations are well distributed and are represented with diverse age classes. Additional sampling is needed to better determine the distribution and abundance of salmonids throughout this area.
- Instream habitat diversity and complexity – Based on available data, instream habitat appears to be insufficiently diverse. In many streams inadequate pool depth and a lack of cover and large woody debris have contributed to a simplification of instream fish habitat.
- In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this subbasin.

## ***Eastern Subbasin Issue Synthesis***

### **Working Hypothesis 1:**

**SUMMER STREAM TEMPERATURES IN MANY SUBBASIN TRIBUTARIES ARE NOT WITHIN THE RANGE OF TEMPERATURES THAT ARE FULLY SUITABLE FOR HEALTHY ANADROMOUS SALMONID POPULATIONS.**

### **Supportive Findings:**

- Based on samples taken from 1996-2001, all maximum weekly average temperatures (MWATs) for Westlund Creek, Mattole Canyon Creek, Blue Slide Creek, and Eubanks Creek were above the 50-60°F range considered suitable for coho growth in the EMDS analysis (except Eubanks Creek in 2001).
- Low canopy density levels appear to result from riparian cover depletion associated with land use, and stream widening due to high sediment inputs, especially during the 1955 and 1964 flood events.

### **Working Hypothesis 2:**

**TRIBUTARY CONDITIONS IN THE EASTERN SUBBASIN ARE THE MOST VARIABLE IN THE MATTOLE BASIN CONCERNING WATER TEMPERATURE, HABITAT DIVERSITY, AND SEDIMENT PRODUCTION.**

### **Supportive Findings:**

- The DFG Coho Assessment Project found coho salmon in three subbasin tributaries with good habitat and favorable water temperatures in 2001.
- However, four tributaries had water temperatures that were not in the suitable range for salmonids.
- Air photos and field observations show that the Mattole River bordering the Eastern subbasin downstream of Honeydew Creek is highly aggraded with sediment. (CGS, 2002)

### **Recommendations:**

1. Where current canopy is inadequate and site conditions are appropriate, use tree planting and other vegetation management techniques to hasten the development of denser and more extensive riparian canopy.
2. Monitor 24-hour summer water and air temperatures to detect trends using continuous monitoring thermographs.
3. Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.
4. Based upon the latest science on placement of large woody debris in stream channels, managers in the Eastern subbasin should work to improve channel structure and function for salmonids.
5. Continue efforts to conduct and implement road and erosion assessments such as in the Dry and Westlund planning watersheds. Initiate road improvements and erosion proofing throughout the subbasin to reduce sediment delivery.

## ***Southern Subbasin***

The Southern Subbasin is located south of Bridge Creek (River Mile 52.1) and McKee Creek (River Mile 52.8), both near Thorn Junction, and continues upstream to the Mattole's headwaters near Four Corners (River Mile 61.5), a distance along the Mattole mainstem of about 9.4 river miles. There are twenty-seven perennial blue line streams that drain a watershed area of 28 square miles. The DFG has recently surveyed 21.9 miles of the subbasins anadromous reaches. Elevations range from 930 feet at Bridge Creek to approximately 1,500 feet in the headwaters of the tributaries. The King Range immediately west of the area influences the Southern subbasin temperature and precipitation totals. Temperatures reflect the inland location ranging from sub-freezing to above 100° F but generally stay between 55° and 85° F. Rainfall totals average between 70 and 85 inches.

## ***Southern Subbasin Issues***

- The use of herbicides on industrial timberlands is of concern for both human health and water quality reasons. The impacts of these applications have not been quantified in this subbasin. Further study of this issue would be recommended.
- There is a higher risk of catastrophic fire in this subbasin due to the high density of human inhabitation in proximity to wild lands.
- Limited road assessment and treatment has been completed in this subbasin. These efforts should be expanded because of the potential for further sediment delivery from active and abandoned roads, many of which are in close proximity to stream channels.
- This subbasin has been disproportionately impacted by road density and location, human habitation, human waste disposal, and land disturbance from building of structures, land modification, and water usage and drainage.
- Excessive extraction of water from springs, tributaries, and the mainstem during summer low flow periods is detrimental to fish survival, particularly in drought years.
- Recent instream sediment sampling data indicates that there are continuing inputs of fine sediments, but this does not appear to be a major limiting factor for salmonid production.
- The geology of the Southern subbasin is the most uniform and is more resistant to erosion and slope instability with the largest continuous areas of hard terrain and lowest landslide density in comparison to the other subbasins in the Mattole watershed (CGS, 2000).
- Most of the active mass wasting activity appears to be in the form of debris slides, and the majority of these are observed adjacent to streams, or in association with roads. The occasional larger dormant landslides are scattered widely throughout the subbasin (CGS, 2000).
- Debris slide slopes are extensive throughout the steep hard terrain (CGS, 2000).
- Portions of the subbasin underlain by active landslides are interpreted as having a very high landslide potential. Areas underlain by moderate to steep slopes are generally interpreted as having a moderate to high landslide potential (CGS, 2000).
- The Bridge Creek PW has shown a significant decrease in negative channel characteristics during this same period, with no change in gullies or lateral bar development. The Thompson Creek PW has low values and has shown no significant change from 1984 to 2000 (CGS, 2000).

- Stream bank erosion in the Southern subbasin does not appear to be significant compared with the other subbasins (CGS, 2000).
- Suitable water temperatures in most streams reflect adequate canopy shade for summer rearing of juvenile salmonids. The best remaining habitat in the Mattole basin is found in this area. This translates to the highest fish productivity rate in the Mattole basin.
- Very high loading of instream of large woody debris has been enhanced by restoration projects since 1996. Future natural recruitment potential for large woody debris is higher in this area because substantial riparian areas along the mainstem are devoted to conservation purposes.
- The DFG (2002) has conducted analyses on macroinvertebrate data collected by the BLM since 1996 on six subbasin streams. The results show the samples were either fair to good, or good in terms of overall conditions. Additional data for aquatic macroinvertebrate productivity would be useful for effectiveness monitoring purposes.
- There is no available data on pH, dissolved oxygen, nutrients, and other water chemistry parameters.
- Removal of in-stream large woody debris under direction of the DFG occurred in about twenty-one miles of streams in this subbasin during the 1980's. A total of 36,800 cubic feet of wood was removed. This is equivalent to 294 logs 2 feet x 40 feet. This activity likely had adverse local impacts on salmonid habitat conditions. Beginning in 1996, a series of DFG funded instream enhancing projects completed by the Mattole Salmon Group have restored much of the complexity by the addition of large woody debris to key stream reaches.
- Wildlife/Plants -- Inadequate information exists to assess the status and trends of flora and fauna, including invasive species.
- Opportunities for public recreation in this area are available but limited to public lands.
- A major salmonid rearing facility exists in the headwaters, operated since 1982 by the Mattole Salmon Group. This operation has been successful and should be continued in order to supplement wild populations of chinook salmon.
- In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this planning basin.

### ***Southern Subbasin Issue Synthesis***

#### **Working Hypothesis 1:**

**WATERSHED AND STREAM CONDITIONS ARE THE MOST SUPPORTIVE OF SALMONIDS IN THE MATTOLE BASIN.**

#### **Supportive Findings:**

- All three species of the Mattole Basin's anadromous salmonids are present in streams throughout this subbasin.
- In general, MWATs in the Southern subbasin are grouped in the high 50° F to low 60° F range. This is within the range suitable for salmonids.

- The DFG Coho Assessment Project found coho in three subbasin tributaries in 2001.
- V[DFG6]-Star (V\*) was 0.04 in Bridge Creek in 2000, which is exceptionally low and may indicate low sediment production due to few, if any, upslope disturbances or rapid sediment transport through well armored pools that may experience high rates of scour during storms.
- The DFG has conducted analyses on macroinvertebrate data collected by BLM since 1996 on six subbasin streams. The results show the samples were either fair to good, or good in terms of overall conditions.

### **Contrary Finding:**

- During the summer, the mainstem Mattole River channel in this subbasin has either intermittent flow or is dewatered above the confluence with Mill Creek.

### **Working Hypothesis 2:**

**SOME REACHES OF STREAMS IN THE SUBBASIN ARE NOT FULLY SUITABLE FOR SALMONIDS DUE TO STREAM FLOW REDUCTIONS RELATED TO HUMAN DIVERSION.**

### **Supportive Findings:**

- Data from the 2000 Census shows that Southern subbasin has the most concentrated human population in the Mattole Basin at 7.4 people per square mile and that most of them are concentrated along the upper Mattole River and its major tributaries.
- Field observations indicate that intermittent flow and dewatering of the mainstem Mattole headwaters area (above Whitethorn) occurs in dry years.

### **Recommendations:**

1. Ensure that this high quality habitat is protected from degradation.
2. Encourage reducing the unnecessary and wasteful use of water to improve river flows and fish habitat.
3. Monitor summer water and air temperatures to detect trends using continuous 24 hour monitoring thermographs.
4. Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.
5. Encourage the use of cable or helicopter yarding on steep and unstable slopes to reduce soil compaction, surface disturbance and resultant sediment yield.
6. Continue efforts such as road assessment, improvements, and decommissioning throughout the basin to reduce sediment delivery to the Mattole River and its tributaries.

## ***Western Mattole Subbasin***

The Western Subbasin lies between the little Bear Creek in the estuary (River Mile 0.3) and the headwaters of the South Fork of Bear Creek (River Mile 50) along the western side of the Mattole

mainstem and Wilder Ridge for a distance of about sixty miles. There are thirty perennial streams that drain a watershed area of 89 square miles. The DFG has recently surveyed 41.5 miles of the subbasin's anadromous reaches. Stream elevations range from 20 feet at the estuary to approximately 2,800 feet in the headwaters of the tributaries in the King Range. Kings Peak, at 4,088 feet, is the highest point in the Mattole River basin. The subbasin is greatly influenced by the King Range, which is its western boundary. Temperatures have a wide range because the mountains cut off the moderating effect produced by marine air. Precipitation totals vary from 70 to 100 inches annually.

### ***Western Subbasin Issues***

- Roads – The rural road system is not as extensive as in the other subbasins; however, there is concern over abandoned roads, and road maintenance issues related to landsliding and sediment input on both public and private lands. Without appropriate maintenance or storm proofing, existing roads, both active and abandoned, may continue to supply sediment. BLM is actively removing or “erosion proofing” many of their roads.
- Sub-division and associated impacts are restricted to the northern and eastern margins of this subbasin, outside of the publicly owned lands. BLM’s road access policies pertaining to public lands are an ongoing issue with residents adjacent to the public lands.
- Limited water chemistry data available indicates acceptable pH, DO, and nutrient levels.
- The geology of the Western subbasin is highly variable but is generally more susceptible to landslides and erosion in the easterly and northerly portions (CGS, 2002).
- Large dormant landslide complexes and a limited number of active landslides are identified on the soft to moderate terrain forming along the highly sheared bedrock present along the Lower North Fork and South Fork of Bear Creek and Lower East Fork of Honeydew Creek (CGS, 2002).
- Relatively few deep-seated dormant landslides but abundant debris slide slope and inner gorge have been mapped in steep and hard terrain of the King Range, along with a moderate number of active debris slide scars concentrated adjacent to drainages (CGS, 2002).
- West of Honeydew and in the upper reaches of Squaw Creek, large deep-seated landslides, historically active earthflows, and gully erosion on grass-covered highlands have been mapped in on the soft to moderate terrain formed along the broad, pervasively disrupted, west-trending Cooskie shear zone (CGS, 2002).
- The moderate terrain is primarily mapped as moderate to high landslide potential (CGS, 2002).
- The hard and soft terrain as well as moderate terrain on the debris slide slopes is typically mapped as high to very high landslide potential.
- The soft terrain is interpreted as having mostly a high to very high landslide potential whereas the moderate terrain ranges from moderate to very high, dependant on occurrence of landslide and debris slide slopes. Stability of the hard terrain is typically interpreted to range from moderate to high potential (CGS, 2002).
- The 2000 air photos reveal that six of the seven PWs within the Western subbasin have shown a significant decrease in negative channel characteristics, with no significant change in the number of gullies (CGS, 2002).
- Two PWs, Big Finely and Squaw Creeks, have shown notable decreases in lateral bar development, which suggest decreases in excess sediment (CGS, 2002).

- Eroding banks are found in localized areas intermittently dispersed throughout the Western subbasin with the notable exceptions of the Shenanigan Ridge and South Fork Bear Creek Planning Watersheds. The Squaw Creek, Honeydew Creek, and Woods Creek PWs have some of the longest total lengths within the subbasin (CGS, 2002).
- Summer [DFG7]high temperatures exceed the suitable range for salmonid rearing in the lower reaches of the larger streams. Temperatures are within fully suitable conditions in upstream reaches of larger and smaller tributaries sampled.
- Based on limited sampling, instream conditions indicate moderate sediment levels. The limited data available suggests that there is a degradation of habitat due to instream sediment accumulation in the lower gradient reaches of the larger tributaries.
- Large woody debris recruitment potential is currently poor for the majority of this subbasin but is expected to improve over time (as a result of the BLM management policies within the King Range National Conservation Area).
- The DFG has conducted a preliminary analysis on data collected by BLM since 1996 on seven tributary streams. The results show the samples were rated as good in terms of overall conditions. Additional data for aquatic macroinvertebrate productivity would be useful for effective monitoring purposes.
- Removal of in-stream large woody debris under direction of the DFG occurred in about forty-nine stream miles in this subbasin during the 1980's. A total of 19,136 cubic feet of wood was removed. This is equivalent to 153 logs 2 feet x 40 feet. This activity likely had adverse local impacts on salmonid habitat conditions. Instream habitat diversity and complexity was impacted by this action.
- Based on current surveys available, instream habitat appears to be recovering.
- In[DFG8]-stream habitat diversity and complexity, based on available survey data, i.e. pool depths, cover, and large woody debris may be adequate for salmonid production.
- All three anadromous salmonid species are present. In 2001, the DFG Coho Assessment Project staff observed coho in four streams in this subbasin. The upper reaches of the three major tributaries in this basin are considered good refugia, and this will continue due to BLM ownership and management of key headwater reaches. Fish populations are low at this time, but are expected to increase due to public stewardship within the basin.
- Three salmon rearing facilities are located within this planning basin and have been operated by the Mattole Salmon Group since the mid 1980's. These operations have generally been successful and should be continued in order to supplement wild populations of chinook & coho salmon to allow long-term restoration efforts to work.
- In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this planning basin.

## ***Western Subbasin Issue Synthesis***

### **Working Hypothesis 1:**

**SUMMER STREAM TEMPERATURES IN SOME SUBBASIN TRIBUTARIES ARE NOT WITHIN THE RANGE OF TEMPERATURES THAT PROVIDE SUITABLE CONDITIONS FOR HEALTHY ANADROMOUS SALMONID POPULATIONS.**

### **Supportive Findings:**

- MWATs for Honeydew Creek reached 78.5°F in 1999. In Bear Creek, MWATs reached 71.5°F in 1998.
- Squaw Creek had MWATs ranging from 70.4°F in 1998 to 69.5°F from 1996-1999.
- Historic [DFG9]timber harvest has reduced canopy closure in near stream areas and likely contributed to elevated stream temperatures.

### **Contrary Findings:**

- MWAT of 57.9°F for 2001 in Noonung Creek.
- MWATs in Mill Creek (lower) consistently within one degree of 58°F for 1997, 1998, 1999, 2001, 1998-1999.

### **Working Hypothesis 2:**

**AGGRADATION FROM FINE SEDIMENT IN SOME STREAM CHANNELS OF THIS SUBBASIN HAS REDUCED CHANNEL DIVERSITY NEEDED TO PROVIDE SUITABLE CONDITIONS FOR ANADROMOUS SALMONID POPULATIONS AND HAS COMPROMISED SALMONID HEALTH.**

### **Supportive Findings:**

- Air photos and field observations show that the Mattole River bordering the Western subbasin downstream of Honeydew Creek is highly aggraded with sediment.
- Field surveys of Lower Honeydew Creek and Squaw Creek found less than 40% of their lower reaches by length were composed of pools, indicating a lack of pool habitat.
- Air photos after the 1955 and 1964 floods indicate significant changes in the stream channel in the Western subbasin.

### **Contrary Findings:**

- V\* of 0.26 for Mill Creek, 0.24 for Squaw Creek and 0.22 for Honeydew Creek in 2000 indicating low to moderate residual pool filling.

### **Working Hypothesis 3:**

**A LACK OF LARGE WOODY DEBRIS IN SOME STREAM REACHES OF THIS SUBBASIN HAS REDUCED CHANNEL DIVERSITY NEEDED TO PROVIDE SUITABLE CONDITIONS FOR ANADROMOUS SALMONID POPULATIONS AND HAS COMPROMISED SALMONID HEALTH.**

### **Supportive Findings:**

- Field observations indicate that amounts of instream large woody debris in the mainstem Mattole River and its tributaries in the Western subbasin are low.
- Historic [DFG10] timber harvest throughout the Western Subbasin tributaries frequently removed large conifer vegetation down to the stream bank, severely reducing the available recruitment supply of large woody debris.
- Riparian vegetation is in size classes that are not expected to contribute large woody debris in significant quantities in the near future.

### **Recommendations:**

1. Ensure that near stream areas are managed to reduce solar radiation and moderate air temperatures in order to reduce heat inputs to the Mattole River and its tributaries.
2. Monitor summer water and air temperatures to detect trends using continuous 24 hour monitoring thermographs.
3. Where current canopy is inadequate and site conditions are appropriate, use tree planting and other vegetation management techniques to hasten the development of denser and more extensive riparian canopy.
4. Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.
5. Continue efforts such as road improvements and decommissioning throughout the basin to reduce sediment delivery to the Mattole River and its tributaries. Road inventories have been completed for a much of this planning basin, and it is recommended that this effort should be continued until a complete inventory is compiled.
6. Maintain and enhance existing riparian cover. Use cost share programs and conservation easements as appropriate.
7. Based upon the latest science on placement of large woody debris in stream channels managers in the Western subbasin should work to improve channel structure and function for salmonids.

## **Next Steps**

As we move forward through the draft process of this document's development, we intend to expand this list of recommendations. NCWAP intended to help landowners and other interested public and private parties to focus their energies from the general basin-level issues, like chronic sedimentation, and overly warm water in the Mattole basin, to specific project level activities that can be accomplished and will cumulatively make a difference to the larger problems. With this focused and orderly approach to multi-scale assessment and project recommendation, efforts can be directed on a priority basis to the most effective improvement projects and stewardship sites.